Reports filed & posted 4/18

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF RESEARCH ADMINISTRATION

RESEARCH PROJECT INITIATION

Date: 17 January 1973

Project Title: "Student Science Training Program (Pre-College)"

Project No: E-27-504

Principal Investigator: Dr. J. L. Lundberg

Sponsor: National Science Foundation

Agreement Period: From January 1, 1973 Until October 31, 1973

Type Agreement: Grant No. GW-8182

Amount: $15,776

Reports Required: Student Participant Information Sheets
Final Director's Report

Sponsor Contact Person (s):

Administrative	Program
W. W. Bolton, Jr. Grants Officer National Science Foundation Washington, D. C. 20550	Dr. L. G. Pauldy Division of Pre-College Education National Science Foundation Washington, D. C. 20550

Assigned to: School of Textile Engineering

COPIES TO:

Principal Investigator	Library
School Director	Rich Electronic Computer Center
Dean of the College	Photographic Laboratory
Director, Research Administration	Project File
Director, Financial Affairs (2)	
Security-Reports-Property Office	
Patent Coordinator	Other_____

RA—3 (6—71)

GEORGIA INSTITUTE OF TECHNOLOGY

OFFICE OF RESEARCH ADMINISTRATION

RESEARCH PROJECT TERMINATION

Date: December 12, 1973

Project Title: "Student Science Training Program (Pre-College)"

Project No: E-27-504

Principal Investigator: Dr. John L. Lundberg

Sponsor: National Science Foundation

Effective Termination Date: October 31, 1973

Clearance of Accounting Charges: by December 31, 1973

Final Report Completed

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Terminated Project File No. _____
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RA-4 (5/70)

E-27-504

FINAL REPORT

1973 National Science Foundation Student Training Program in Polymer, Fiber and Textile Science and Engineering at the Georgia Institute of Technology

June 25 - August 10, 1973

-Abstract-

Thirty-one students from 28 high schools in 6 states worked on 24 research projects with 16 research advisors in polymer, fiber and textile science and engineering. In at least 20 projects, decent, meaningful experimental data were obtained; results from five or more of these projects will be published. Study of science and mathematics as well as topics in engineering without separation into the traditional disciplines seemed to be effective. Students attended about 60 seminars including those at which they presented their own research and special talks by visitors. Participants benefited from the diversity of research opportunities, unstructured work with much individual attention, catholic definition and treatment of sciences, and widely varied activities. The necessity for choosing continually among alternatives in academic and extracurricular activities on campus was particularly valuable for these students whose experience has been limited to rather rigidly structured schools offering few choices.

Submitted by:

John L. Lundberg
NSF-SSTP Director
School of Textile Engineering
Georgia Institute of Technology

ABSTRACT

Thirty-one students from 28 high schools in 6 states worked on 24 research projects with 16 research advisors in polymer, fiber and textile science and engineering. In at least 20 projects, decent, meaningful experimental data were obtained; results from five or more of these projects will be published. Study of science and mathematics as well as topics in engineering without separation into the traditional disciplines seemed to be effective. Students attended about 60 seminars including those at which they presented their own research and special talks by visitors. Participants benefited from the diversity of research opportunities, unstructured work with much individual attention, catholic definition and treatment of sciences, and widely varied activities. The necessity for choosing continually among alternatives in academic and extracurricular activities on campus was particularly valuable for these students whose experience has been limited to rather rigidly structured schools offering few choices.

I. Preparation

The School of Textile Engineering prepared a brochure (Appendix I) and distributed it to all principals, counselors, and teachers of sciences and mathematics in secondary schools in the public school systems in metropolitan Atlanta and to principals of all high schools, teachers of science listed with the Georgia Education Association, and members of the Science Teachers Association throughout Georgia. Administrative offices of the principal school districts throughout southeastern United States received brochures. Approximately 6500 brochures were distributed in this way. The Education Department of the Georgia State Government provided mailing labels and address lists and helped in other ways.

Distribution to private and parochial schools was less than adequate. We know more people in the school systems, public and private, than we did last year; we shall reach more students in non-public schools in 1974 than we did in 1973.

Georgia Tech's SST program was publicized in many local newspapers in Georgia, in Georgia Tech publications including alumni news, by announcements at science fairs and teachers meetings, and by individual conversations. News items in a textile trade publication, a technical journal, and an alumni magazine were particularly effective in reaching outstanding participants through their parents.

Some 400 to 500 students and teachers inquired about the program. Thirty nine (39) students submitted completed applications (Appendix II) including students' statements of career plans and interests, letters of recommendation, and supporting documents. Only serious applicants submitted completed applications. Based upon our experience with Georgia Tech students (average of SAT scores ~1200) and rating as "good" those whom we would welcome as

undergraduates in engineering and science at Georgia Tech, our estimates of the abilities of participants and other applicants is as follows:

	Gifted	Very Good	Good	Fair	Poor	Limited Opportunity in Science
Participants	12	10	8	1	0	17
Other applicants	4	3	0	0	1	3
	16	13	8	1	1	20

At least twenty (20) applicants had what was for them limited opportunity in science; in at least twelve (12) cases opportunities were limited by any reasonable minimum standards.

Candidates were selected on the basis of ability, limited opportunity in science, and evidence of real interest in the program. Thirty-seven (37) applicants were accepted; six (6) declined. Two (2) applicants, who declined, attended other SST programs.

The thirty-one (31) participants in Georgia Tech's 1973 SST program might be described in part by the following information:

Number of girls	9
Number of boys	22
Number of members of minority groups	5
Number from the "inner city"	0
Number from suburbs or smaller cities	16
Number from small towns and rural areas	15
Number with superior over-all opportunity	6
Number with good over-all opportunity	10
Number with average over-all opportunity	5
Number with limited over-all opportunity	10
Number who lived on campus during program	29

The participants are as follows:

Name	High School
Lillian Louise Baker General Delivery Iron City, Georgia 31759	Seminole County High Marianna Road Donalsonville, Georgia 31745
Bruce Jerome Barrett 130-1/2 Eleventh Street Barnesville, Georgia 30304	Lamar County Forsyth Road School Forsyth Road Barnesville, Georgia 30204
David Theodore Bell Route Two Buckhead, Georgia 30625	Morgan County High School College Drive Madison, Georgia 30650
Henry Douglas Blount Route 3 - Box 97 Greenville, Georgia 30222	Greenville High School P. O. Box T Greenville, Georgia 30222
Thomas Eugene Brown Box 277 Reidsville, Georgia 30453	Pinewood Christian Academy Bellville, Georgia 30414
Sherman Overton Childers 623 Robinson Drive Jesup, Georgia 31545	Wayne County High West Orange Street Jesup, Georgia 31545
Lisa Ann Daniel 3308 Lookout Drive, S.E. Huntsville, Alabama 35801	Huntsville High School 2304 Billie Watkins Huntsville, Alabama 35801
John Francis Follin 3111 N.E. 55th Street Ft. Lauderdale, Florida 33308	Pinecrest Preparatory School 1501 N.E. 62nd Street Ft. Lauderdale, Florida 33308
Kay Susan Gardner 302 Somerset Lane Montgomery, Alabama 36109	Robert E. Lee High School 225 Ann Street Montgomery, Alabama 36109
Peter A. G. Golden 2228 Walden Drive Augusta, Georgia 30904	Richmond Academy Augusta, Georgia 30904
Victoria Mynette Gordon 1100 Burton Drive, N.E. Atlanta, Georgia 30329	Briarcliff High School 2415 North Druid Hills Road, N.E. Atlanta, Georgia 30329
Sara Buck Granville 463 North Beach Street Ormond Beach, Florida 32074	Seabreeze Senior High 2700 Oleander Avenue Daytona Beach, Florida 32018

Name	High School
Kathy Jane Ingram Route 3 - Box 290 Donalsonville, Georgia 31745	Seminole County High School Marianna Highway Donalsonville, Georgia 31745
Steven Mark Irby 2069 Castleway Drive, N.E. Atlanta, Georgia 30345	Lakeside High School 3801 Briarcliff Road, N.E. Atlanta, Georgia 30345
Travis Lamar Jarvis 306 East Carr Street Donalsonville, Georgia 31745	Seminole County High School Marianna Highway Donalsonville, Georgia 31745
David L. Larson Kennett Pike Mendenhall, Pennsylvania 19357	Tower Hill School 2813 West 17th Street Wilmington, Delaware 19806
Ralph Arthur Liebelt 3213 Walton Way Augusta, Georgia 30904	Richmond Academy 961 Baker Avenue Augusta, Georgia 30904
Brenda Lorie Long Route 4, 234 Falcon Drive Lexington, South Carolina 29072	Pelion High School Pelion, South Carolina 29123
Robert Eugene Mann, Jr. 1201 Sherwood Drive Dalton, Georgia 30720	Dalton High School West Crawford Street Dalton, Georgia 30720
Steven Michael Mullins Route 6 - Box 440 Dalton, Georgia 30720	North Whitfield High School Route 8 Dalton, Georgia 30720
Keith Robert Nelms 810 North Washington Street Sylvester, Georgia 31791	Worth County High School East Price Street Sylvester, Georgia 31791
Catheryn Camille Newberry 209 West Crawford Street Donalsonville, Georgia 31745	Seminole County High School Marianna Highway Donalsonville, Georgia 31745
Mollie Marie Newsome P. O. Box 1 Stapleton, Georgia 30823	Stapleton Academy P. O. Box 98 Stapleton, Georgia 30823
Kelvin Lamar Rawls 656 West Pine Street Jesup, Georgia 31545	Wayne County High West Orange Street Jesup, Georgia 31545
Robert James Saxton 940 Fort Lane Drive Orlando, Florida 32806	Trinity Preparatory School 8400 Aloma Avenue Orlando, Florida 32807

Name	High School
Harvey James Sells 3182 Lake Avenue Hapeville, Georgia 30354	Hapeville High School North Fulton Avenue Hapeville, Georgia 30354
Glenn Daniel Sizemore Route Two Ocilla, Georgia 31774	Irwin County High School Sixth Avenue Ocilla, Georgia 31774
Eric Carlton Tillman P. O. Box 861 St. Marys, Georgia 31558	Camden County High School St. Marys, Georgia 31558
Mark Culpepper Walker Club Drive, Route 4 Lawrenceville, Georgia 30245	Berkmar High School Lilburn, Georgia 30245
Robert Ernest Watson, Jr. Route 1 - Box 262 Waycross, Georgia 31501	Ware County Senior High School Cherokee Avenue Waycross, Georgia 31501
Gaylord Virgil Wingate 1375 Graham Road Mansfield, Ohio 44903	Lexington Senior High School 103 Clever Lane Lexington, Ohio 44904

II. Program

Instructors for the Georgia Tech SST program in 1973 were

Name	Degree	Position	Specialty	Seminar	Research
Boteler, Winston C.	M.S. (M.E.)	Assoc. Prof.	Textile & Mech. Engineering	X	X
Carter, Walter C.	Ph.D. (Chem)	Prof.	Textile & Polymer Chemistry	X	X
Cook, Fred L.	M.S. (Text.Chem)	Grad. Asst.	Textile & Polymer Chemistry		X
Eichholz, Geoffrey G.	Ph.D. (Phys)	Prof.	Nuclear Science & Engineering		X
Freeston, W. Denney	Ph.D. (M.E.)	Prof. & Director	Textile & Mech. Engineering	X	X
Gentry, David R.	Ph.D. (Mgt.)	Assoc. Prof.	Textile Management	X	X
Hester, Roger	B.S. (Ch.E.)	Grad. Asst.	Polymer Engineering		X

Name	Degree	Position	Specialty	Seminar	Research
Ko, Frank	M.S. (T.E.)	Grad. Asst.	Textile Engr. & Fiber Science		X
Liotta, Charles L.	Ph.D. (Chem)	Assoc. Prof.	Organic & Polymer Chemistry		X
Livesay, B. R.	Ph.D. (Met.)	Sr.Sct., EES	Metals & Physics		X
Lundberg, John L.	Ph.D. (Chem)	Callaway Prof.	Polymer Chemistry & Physics	X	X
Maguire, A. J., III	M.S. (Text)	Adm.Spec. (Counselor)	Textile Management		X
Muzzy, John D.	Ph.D. (Mat.Sci.)	Assoc. Prof.	Polymer Engineering		X
Porter, Rick A.	M.S. (Text)	Asst. Prof.	Textile & Polymer Chemistry		X
Rice, Donald L.	B.S. (Text.Chem)	Grad. Asst.	Textile & Polymer Chemistry		X
Simon, James S.	B.S. (Engr)	Grad. Asst.	Nuclear Science & Engineering		X
Tincher, Wayne C.	Ph.D. (Chem)	Assoc. Prof.	Textile & Polymer Chemistry	X	X

Special lecturers and seminar speakers from off campus were

Name	Degree	Position	Subject
Bostic, James	Ph.D. (Text.Chem)	White House Fellow & Deputy Asst.Sec.,USDA	White House Fellows Program
Hawkins, W. L.	Ph.D. (Chem)	Head Plastics R&D Bell Labs,Murray Hill, New Jersey	Stability of Polymers
*Daniel, Alfred C.	Ph.D. (Phys)	Mgr.,Textile Rubber & Chem.Co.,Dalton,Ga.	Physics, polymers, etc.
*Liebelt, Robert A.	M.D.	Provost, Medical Col. of Ga., Augusta, Ga.	Role of Fibrous Tissue in Medical Biology
Grim, George	Ph.D. (Phys)	Mgr., Corporate Res. Owens-Corning Fiberglas Granville, Ohio	Glass Fibers

*Fathers of participating students.

Other special lecturers from Georgia Tech were:

Eichholz, Geoffrey G.	Nuclear Science & Engineering
Maguire, A. J., III	Careers, Colleges and Choice College Applications, Entrance, Majors, etc.
Lundberg, John L.	Mechanics: Newtonian & Quantum Statistical Thermodynamics Science, Engineering, etc.

The seminar program in polymer, fiber, and textile science and engineering is as given in the proposal except that the last three seminars were presented by the students describing their research projects. The seminar subjects are given in Appendix III.

The over-all program is as given in the proposal except that it was condensed from ten to seven weeks and more time than initially proposed was devoted to orientation, familiarization with research, and selecting research problems and advisors. These changes were suggested by Dr. L. G. Paldy and other staff members of the Foundation. For their sound advice, we are most grateful.

Sunday, June 24th, was devoted to picking up students at transportation terminals, welcoming students and parents to campus, checking into dormitories, getting acquainted, learning to know counselors, etc. Specific orientation programs with tours included orientation to the Georgia Tech campus, the Price Gilbert Memorial Library, the School of Textile Engineering, the Georgia Tech Experiment Station, the Rich Computer Center, and to recreational facilities.

Seminars and research orientation began on Monday, June 25th. Students began to select research problems and advisors toward the end of the first week after some six to eight hours had been spent in learning to know the faculty and research problems. Most students had selected research problems by the middle of the second week. Seminars continued through the whole seven

weeks of the program. Most students started their research work in the second or third week of the program.

Weekly programs were distributed to all participants and faculty; a composite of these makes up Appendix IV.

Science movies were shown at least sixteen (16) times, almost always on weekday evenings. Each film was shown twice, at two different times. Attendance was voluntary. These movies, from Encyclopedia Britannica Films and the Georgia Tech Library, were a substantial supplement to the program. A list of films shown is given in Appendix V.

Other programs of scientific or technical nature included a trip to the Fernbank Science Center for short lectures and demonstrations in meteorology, electron microscopy, and astronomy as well as a nature walk. The participants and staff visited the Jefferson Mills in Jefferson, Georgia, to see yarn formation, weaving, and dyeing and finishing in a well engineered, fully competitive textile operation.

An active recreation program was planned for weekends and the Fourth of July. Points of interest visited and activities were:

High Museum of Art, Atlanta
Georgia State Capitol
Underground Atlanta
Atlanta Stadium: Braves vs. Giants
Tennis tournament
Lenox Square, Atlanta - fireworks
Jazz Festival - Atlanta Stadium
Stone Mountain
Lundberg residence - twice
Six Flags over Georgia
Warm Springs, "The Little White House"
Callaway Gardens
Lake Allatoona - picnic with Fernbank Science Center SSTP

In addition Saturday evening trips to movie theaters as well as concerts of the Atlanta Symphony Orchestra were provided.

Miss Sandra Boney, graduate student in textiles, served as counselor for and lived with the girl participants. Mr. Eric Esche, sophomore in textiles, was counselor for and lived with the boys. Mr. A. J. Maguire, III, Administrative Specialist (advisor to entering students), was counselor for and directed social activities, off-campus, and out-of-hours activities for the participants.

The purpose of and principal thrust of the Georgia Tech SST program was to introduce students to research. The thirty-one (31) participants worked on twenty-four (24) different research projects with sixteen (16) research advisors. Decent experimental results were obtained in at least twenty (20) of these problems. Results from at least five of these studies will be published when more data have been collected and analyzed. The students, problems, and advisors are as follows:

Childers, Sherman	Viscoelastic behavior of strong nylons	F. Ko
Watson, Bobby	Viscoelastic behavior of strong nylons	F. Ko
Ingram, Kathy	Spider fibers	F. Ko
Newberry, Cathy	Spider Fibers	F. Ko
Brown, Tommy	Light scattering: solutions & fibers	J. L. Lundberg
Golden, Peter	Light scattering: solutions & fibers	J. L. Lundberg
Rawls, Kelvin	Light scattering: solutions & fibers	J. L. Lundberg
Barrett, Bruce	Viscoelastic behavior of elastin structures	B. R. Livesay & J. L. Lundberg
Liebelt, Ralph	Viscoelastic behavior of elastin structures	B. R. Livesay & J. L. Lundberg
Tillman, Eric	Viscoelastic behavior of elastin structures	B. R. Livesay & J. L. Lundberg
Gordon, Vickie	Transverse properties of fibers	W. D. Freeston
Sells, Harvey	Strengths of materials at low temperatures	W. D. Freeston
Bell, David	High speed testing of fibers	W. D. Freeston
Long, Brenda	High speed testing of fibers	W. D. Freeston
Larson, David	Fabric ignition & heat transfer in fabrics	W. D. Freeston

Granville, Sara	Nomenclature and properties of organic compounds	R. A. Porter
Jarvis, Lamar	Solvent dyeing	R. A. Porter
Newsome, Mollie	Solvent dyeing	R. A. Porter
Baker, Louise	Smoke production by burning carpets	W. C. Tincher
	Opportunities for members of minorities in science and engineering	A. J. Maguire
Irby, Steve	Polychlorinated biphenyls in H_2O - spectrofluorometry	W. C. Tincher
Sizemore, Glenn	Pollution potential of waste from dye baths for carpets	W. C. Tincher
Mann, Bob	Thermal analysis of PVC & PVC-PVA copolymers	W. C. Tincher
Gardner, Kay	Reactive dyes for cellulose	W. C. Carter
Wingate, Chip	Orientation of polymers in fields	W. C. Carter
	Crystallization and morphology of poly-(β- hydroxypropionic acid)	W. C. Carter
Nelms, Keith	Electrets and electromechanical and electrical behavior	J. L. Lundberg
Blount, Doug	Textile management simulation studies	D. B. Gentry
	Opportunities for members of minorities in science and engineering	A. J. Maguire
Daniel, Lisa	Properties of PVC latexes and fillers	W. C. Boteler
Walker, Mark	Structure of collagen	D. L. Rice
Follin, John	Hg concentration in tuna by activation analysis	G. Eichholz & J. Simon
Mullins, Steve	Synthesis of polymers for carbon fibers	C. Liotta & F. Cook
Saxton, Bobby	Reclaiming plastics	J. Muzzy & R. Hester

III. Evaluation of the Project

A. Students' Assessment

Students' evaluations of the Georgia Tech 1973 SST program were favorable, perhaps, too much so. On August 30, 1973, Mr. A. J. Maguire, Counselor for Incoming Students in the School of Textile Engineering, sent to participants a questionnaire (Appendix VI). Twenty-six (26) of a possible thirty-one (31) responses were received by October 1, 1973. Numerical results are given in Appendix V. From the student evaluations we conclude:

1) Seminars probably were too long

2) Seminars should be limited to 90 minutes per day

3) Seminars were conducted at about the right level (freshman to sophomore level in college)

4) We should have had more than five (5) seminar speakers from off campus and one (1) from another school at Georgia Tech

5) About the right amount of material was covered in the right number of seminars

6) We had enough different research topics

7) Sufficient time was spent on research

8) Students were satisfied with faculty assistance in research

9) Material and instrument procurement was easy for about 60 percent of the students and difficult for 40 percent

10) More time should have been devoted to orientation to research facilities on campus

11) Students appreciated and enjoyed organized outings for recreation

12) At least twenty (23) of the twenty-six (26) respondents will recommend the Georgia Tech SSTP to fellow students without change or with minor changes in the program

B. Good Points

Effective features of the program were first and foremost, the research. Most of the participants got real results; most remained or became "turned on" by science or engineering. All participants remained in the program and were active for the whole seven weeks.

The extra seminars were particularly effective. Five visitors came from New Jersey, Ohio, Washington, D. C., and from Augusta and Rome in Georgia to present seminars; these visitors received no expense monies nor honoraria from Georgia Tech.

Teaching science and engineering without regard to disciplines and teaching mathematics as part of science was enjoyable and appeared to be effective. Comments from students about the help to them that an understanding of the fundamentals of subjects, such as calculus, for example, has been since they have returned to school are gratifying and indicate that teaching science and mathematics together gives relevance to an otherwise abstract subject.

Living on campus with all of the distractions and temptations of Atlanta probably helped several of the students to adjust to being at college away from home without the penalty of failure. A few of the students probably would have failed in the first quarter or semester in college without this experience.

C. Problems

The greatest single problem was helping the students to some feeling for the nature of science and engineering. Most of the students' experience is limited to learning in school with a highly structured, organized, and quite dogmatic approach and system. Few students have any feel for the experimental method and deductive reasoning. Further, few of the students

seemed to have been encouraged to doubt, question, and test what they read and what they are told. Most of the participants are not skilled in working in unstructured laboratory programs; therefore, the research experience while helpful to the student required judgment and patience from research advisors to prevent students from becoming bogged down or being led by the hand.

In answering students' questions concerning colleges, curricula, research, etc. the dependence of even the brightest and most independent upon the structured requirements, curricula, and mode of operation of secondary schools became apparent. Most high school students seem to have difficulty comprehending the range of choices offered in a college or university.

D. Changes in Future Programs

Changes which we shall make in programs in future years will be to provide more research problems in more fields in the School of Textile Engineering and in other schools at Georgia Tech. This will give students greater choice in selecting research problems. Also, we shall be able to accommodate a wider variety of student originated research problems in future years. The number, range of interests, research activity, and interdisciplinary collaborative efforts of faculty members in the School of Textile Engineering and other schools at Georgia Tech is increasing.

We shall have more research problems closer to "go" condition in future years. In some cases participants spent too much time in obtaining equipment and materials. Further, we shall explore methods to help students to define problems more quickly than they might otherwise, and do this without "leading the students by the hand".

E. Effects of Program

The effect on participants was to increase in each an appreciation of science and engineering and an eagerness for real study at the university

APPENDIX I

Form 1
(To be filled out by student applicant)

Applications should be returned by April 10, 1973. Please send to:

Dr. John L. Lundberg
School of Textile Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

1973 SUMMER PROGRAM
in
POLYMER, FIBER & TEXTILE
SCIENCE & ENGINEERING
for
Secondary School Students
at the
Georgia Institute of Technology
June 25, 1973 - August 10, 1973

APPLICATION FOR ADMISSION

Eligibility and Selection

Thirty (30) students will participate in Georgia Tech's 1973 Summer Program in Polymer, Fiber & Textile Science & Engineering supported in part by the National Science Foundation Science Student Training Program. Selection will be on the basis of the following criteria:

1. Completion of the junior year in a secondary school by June, 1973.
2. Evidence of latent or developed interest and ability in science and engineering in recommendations from teachers and principal or guidance counselor.
3. Applicant's stated reasons for wishing to attend the program.
4. Completion of two or more units of science or mathematics in high school.
5. Scholastic standing in high school class.
6. Written approval of applicant's parent or guardian giving permission to attend and participate in the program.

I hereby apply for participation in the 1973 Summer Program in Polymer, Fiber & Textile Science & Engineering. I agree to obey and conform to all rules and regulations of the Georgia Institute of Technology including those established for this program.

Signature _____ Date _____

Please type or print your answers to the following items:

1. Name: _____
(last) (first) (middle)

2. Social Security Number: _____
(Note: You must have a social security number to participate; please apply for one now if you do not have one.)

3. Date of Birth: _____

4. Address: _____
(No. & Street) (City) (State) (Zip)

5. Telephone Number: _____ 6. Sex: Male ____ Female ____
(Area Code) Number

7. Father's Name: _____ Mother's Name: _____

Occupation: _____ Occupation: _____

Address: _____ Address: _____

_____ _____

8. Name of High School: _____

School Address: _____
(No. & Street) (City) (State) (Zip)

School Telephone Number: _____
(Area Code) Number

9. Year Completed in high school as of June, 1973: _____

10. Courses taken in high school:

a. Courses you have taken, or are now taking in high-school science (grades 9 and up):

_____ _____ _____

_____ _____ _____

b. Courses you have taken, or are now taking, in high-school mathematics (grades 9 and up):

_____ _____ _____

_____ _____ _____

c. Courses you are still planning to elect in science and mathematics before you graduate from high school:

_____ _____ _____

_____ _____ _____

11. What is the approximate population of your town? _____

Is it a metropolitan suburb? Yes ____ No ____ Of what city? _____

12. What is your major academic area of interest? _____

Other hobbies and strong interests? _____

13. Describe briefly your participation in science activities, both in and out of school (clubs, fairs, rallies, offices, held, etc.):

_____

_____

14. Describe briefly your participation in non-science activities, both in and out of school (athletics, orchestra, band, clubs, debates, theatre, etc.):

_____

_____

15. Honors won, both in and out of school: _____

_____

16. Have you ever participated in a Student Science Training Program supported by the National Science Foundation? Yes _____ No _____

If yes, please fill in the following:

Name of Host Institution: _____ Location: _____
Director: _____ Dates: _____
Subject field(s) you studied: _____
Description of program: _____

17. On a separate sheet, attach an essay of about 300-500 words explaining why you wish to participate in this program and your plans for the future. Please include any additional information about your interests and activities that you feel is pertinent.

18. Please list the full names and addresses of your school administrators:

a. Guidance Counselor: _____

_____

_____

b. High School Principal: _____

_____

_____

Form 2
(To be filled out by school principal or guidance counselor)

Student's Name: _____

School Name: _____

City & State: _____

School Telephone: _____
(Area Code) Number

Please return this form by April 10, 1973. Please send to:

Dr. John L. Lundberg
School of Textile Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Telephone (404) 894-2496

1973 SUMMER PROGRAM
in
POLYMER, FIBER & TEXTILE
SCIENCE & ENGINEERING

for
Secondary School Students

at the

Georgia Institute of Technology

June 25, 1973 - August 10, 1973

Dear Colleague:

One of your students _____ seeks acceptance in our 1973 Summer Program in Polymer, Fiber & Textile Science & Engineering. Selection will be on the basis of the following criteria:

1. Completion of the junior year in a secondary school by June, 1973.

2. Evidence of latent or developed interest and ability in science and engineering in recommendations from teachers and principal or guidance counselor.

3. Applicant's stated reasons for wishing to attend the program.

4. Completion of two or more units of science or mathematics in high school.

5. Scholastic standing in high school class.

6. Written approval of applicant's parent or guardian giving permission to attend and participate in the program.

We would appreciate your providing us with the information about _____ by answering the questions on the following pages and returning the form promptly. All correspondence will be kept confidential. Thank you for your help.

Very truly yours,

John L. Lundberg

1. Student's Name: _____

2. In the blanks below, please list the courses taken by the student in high school, together with the year in which the course was taken, and the final grade received. (If you prefer, a regular transcript may be attached to this form).

	School Year	Course	Grade
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

3. In the space below, will you please list any ability, achievement, or other standardized tests administered to the student for which you have scores? Please indicate the name of the test, the form and score (percentile, standard score, grade equivalent, etc.) received. All tests from the seventh grade up may be listed.

Test	Form	Date Administered	Rating or Score

4. a. Will you please indicate the total number in the present junior class in which the student is enrolled: _____

   b. Please indicate the student's rank in the class in terms of achievement: _____

5. Will you please give a general statement of the student, describing as best you can his personality characteristics:

_____

_____

_____

6. In your opinion, do you think the student is likely to profit from seven weeks of study and research in science and mathematics? Yes _____ No _____

Comments (why, how, etc.): _____

_____

_____

7. We seek students who have the ability to become good engineers and scientists but who have had limited opportunity or little encouragement to study science. Is this applicant a member of this group? Please comment on evidence of latent interest and ability in science.

_____

_____

_____

8. Please comment as you see fit (or call J. L. Lundberg).

Signed: _____

Title: _____

School: _____

Form 3
(To be filled out by science teacher)

Student's Name: _____

School Name: _____

City & State: _____

School Telephone: _____
(Area Code) Number

Please return this form by April 10, 1973. Please send to:

Dr. John L. Lundberg
School of Textile Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Telephone (404) 894-2496

1973 SUMMER PROGRAM
in
POLYMER, FIBER & TEXTILE
SCIENCE & ENGINEERING

for
Secondary School Students

at the

Georgia Institute of Technology

June 25, 1973 - August 10, 1973

Dear Colleague:

One of your students _____ seeks acceptance in our 1973 Summer Program in Polymer, Fiber & Textile Science & Engineering. Selection will be on the basis of the following criteria:

1. Completion of the junior year in a secondary school by June, 1973.
2. Evidence of latent or developed interest and ability in science and engineering in recommendations from teachers and principal or guidance counselor.
3. Applicant's stated reasons for wishing to attend program.
4. Completion of two or more units of science or mathematics in high school.
5. Scholastic standing in high school class.
6. Written approval of applicant's parent or guardian giving permission to attend and participate in the program.

We would appreciate your providing us with the information about _____ by answering the questions on the following pages and returning the form promptly. All correspondence will be kept confidential. Thank you for your help.

Very truly yours,

John L. Lundberg

1. Students Name: _____

2. How long and in what capacity have you known the student? _____

_____

3. What is your judgment of the candidate's mental ability? Please check.

Exceptional _____
(the type that would be encountered very infrequently)

Superior _____

Good _____

Average _____

4. How would you rate the applicant's behavior? Please check.

Beyond normal maturity for his age _____

Normal for his age _____

Immature for his age _____

5. What are the applicant's relationships with his classmates? Please check.

Definite leadership _____

Mingles well and has respect _____

Somewhat retiring _____

6. Please comment briefly on the industry and work habits of the applicant:

7. Is the applicant interested in science and mathematics beyond the assigned and required work? Yes _____ No _____

Is the applicant interested in other subjects beyond the assigned and required work? Yes _____ No _____

If yes, please explain briefly:

8. When corrected for a mistake or error, how does the applicant respond?

Accepts criticism objectively _____

Attempts to correct behavior _____

Makes excuses for errors _____

Reacts negatively to criticism _____

9. How would you describe the applicant's personal appearance?

Unusually neat _____

Neat _____

Untidy _____

10. How does the applicant behave in the laboratory? Please check the approximate position on the line scale.

0	1	2	3	4	5	6	7	8	9	10
Careless and untidy					Average for student of this age				Unusually careful and accurate	

11. What is your opinion concerning the future of this student in the field of science and mathematics? Please state briefly.

12. We seek students who have the ability to become good engineers and scientists but who have had limited opportunity or little encouragement to study science. Is this applicant a member of this group? Please comment on evidence of latent interest and ability in science.

13. Do you think this student will profit from this opportunity for intensive study of science and mathematics? Yes _____ No _____

Comments:

14. Please comment as you see fit (or call J. L. Lundberg).

Signed: _____

Position: _____

School: _____

Form 4
(To be filled out by parent or guardian of student applicant).

Please return this form as soon as possible and in no-case no later than April 10, 1973. Please send to:

Dr. John L. Lundberg
School of Textile Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Telephone: (404) 894-2496

Student's Name: _____

School Name: _____

City & State: _____

Telephone: _____
(Area Code) Number

1973 SUMMER PROGRAM
in
POLYMER, FIBER & TEXTILE
SCIENCE & ENGINEERING

for
Secondary School Students

at the

Georgia Institute of Technology

June 25, 1973 - August 10, 1973

Dear Parent or Guardian:

Your son or daughter seeks admission to our 1973 Summer Program for high school students supported in part by the National Science Foundation.

The costs of instruction and research are paid by Georgia Tech and NSF. Students are expected to pay all expenses for room, board, and travel. For students from Atlanta, who may commute, costs should be thirty cents per day bus fare plus one dollar or less for lunch. Room and board (including the usual student activities fee paid by all students at Georgia Tech) will be about $350 for the seven week session.

The National Science Foundation has provided limited funds, which the program director can use at his discretion, to help meet costs of board, room, and travel as well as commuting and lunch for participants who would not be able to attend without some financial aid. To help in allocating these limited funds to students who most need assistance, the information requested on the attached form is required. These forms will be kept confidential and the information will be given to no one. Admission to the program is based upon students' qualifications without regard to financial aid. The cost to each student will be determined on an individual basis after all forms have been received by the program director.

A deposit of twenty dollars ($20), which is not returnable, must be sent when a student accepts an offer to participate in the program.

Notification of students' selection will be sent about April 15, 1973.

Very truly yours,

John L. Lundberg
NSF-SSTP Director
School of Textile Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Please return as soon as possible
(before April 10, 1973) to:

Dr. John L. Lundberg
NSF-SSTP Director
School of Textile Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

1973 SUMMER PROGRAM
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Please fill out all the appropriate spaces:

1. Name and address of student applying:

   Name: _____
   Address: _____
   _____

2. It will be possible to pay about $350 plus travel costs for the participant named above, without severe financial hardship.

   Yes _____ No _____

3. If the answer to question 2 is "Yes" go directly to the bottom, sign your name and return this form. If the answer to question 2 is "No" please check the appropriate blank below:

   It will be possible for me to contribute the following amount without severe financial hardship:

   a. $300 to $350 plus travel _____
   b. $250 to $300 plus travel _____
   c. $200 to $250 plus travel _____
   d. $150 to $200 plus travel _____
   e. $100 to $150 plus travel _____
   f. $50 to $100 plus travel _____
   g. $1 to $50 plus travel _____
   h. Travel only _____
   i. none _____
   j. Commuting & Lunch _____

4. Occupation of parent: _____

5. Names of minor children and ages:

   _____ _____ _____
   _____ _____ _____

Signed: _____

1. We expect the participant will remain at Georgia Tech for the full period and will not travel home or elsewhere on weekends. No participant may drive or ride in a private car while he is in the Program

2. He will be expected to conform to the regualtions of Georgia Tech that are established for the program.

3. Your signature indicates your tentative approval for his attendance at the program if he is selected.

4. Your approval for his attendance may be withdrawn at your pleasure.

5. Forms consenting to participation, permission for emergency medical treatment, etc., will be required if the applicant is selected.

Signature of Parent: _____

Address: _____

_____

APPENDIX III

SEMINARS FOR NSF-SSTP JUNE 25 - AUGUST 10, 1973

No.	Subject
1.	Introduction to Polymers and Fibers - What is a polymer? Why are they different from gases? some liquids? some solids? Demonstrate various polymers, molecular models; show properties such as bounce, great strengths of fibers, importance to life processes, etc.
2.	Stress-Strain Behavior - Force; Newton's second law; Hooke's law; stress-strain behavior of Al_2O_3, C, BN, glass, organic fibers; non-linear stress-strain behavior; creep; demonstrations using tensile apparatus.
3.	Concept of Equilibrium - Equilibirum of forces, static systems, dynamic systems, acceleration, Newton's first and second laws, the pendulum demonstration, dynamic equilibrium.
4.	Near Equilibrium Kinetics - The postulate, the pendulum, Newton's law of cooling, viscous flow, turbulent flow, Ohm's law.
5.	Viscous and Elastic Behavior of Polymers - Demonstrate with PIB, glass, honey, etc.; linear visoelasticity; "dash pots" and springs (door closers, shock absorbers, and polymers); tensile creep.
6.	Molecular Size - Methane to polyethylene, lengths of polymer molecules to scale (pull chain model), polymers we can see in the electron microscope (DNA), two dimensional polymers (crosslinking), three dimensional polymers (graphite, diamond, SiO_2, water, etc.).
7.	Chemical Bonding, Carbon-Carbon - CH_4, alkanes, polyethylene, diamond; benzene, styrene, polystyrene, graphite; acetylene, C_2, etc., covalent bonding; ionic bonding; complete electron shells.
8.	Chemical Bonding, Carbon-Carbon - Vinyl polymerization, ethylene to polyethylene, free radicals, free radical initiation and propagation, side reactions, branching, ionic polymerization, branched vs. linear polyethylene.
9.	Chemical Bonding-Carbon - Carbon - Vinyl polymerization of substituted ethylene, free radical vs. ionic, polypropylene, polyisobutylene, stereoregularity, properties of polymers, polyvinyl chloride, polyacrylonitrile.

Chemical Bonding, Carbon-Carbon - Copolymers, polybutadiene, polyisoprene, synthetic rubbers, acrylonitirle-butadiene-styrene resins, saran, modacrylics.

10. Chemical Bonding, Carbon-Oxygen - Alcohols, acids, acidity, bases, bacicity, ethers, esters, polyethers, polyesters.

11. Chemical Bonding, Carbon-Oxygen - Poly (ethylene terephthalate), cellulose, poly(methylene oxide), starch.

12. Chemical Bonding, Carbon-Nitrogen - C-N & C≡N Bonds, NH_3, amines, bases & bacicity, ammonium salts, amides, polyamides, nylon rope trick, nylons.

13. Chemical Bonding, Carbon-Nitrogen - Nylon 6, nylon 66, other nylons, proteins, enzymes.

14. Chemical Bonding, Other Atoms - P-O, S-C, S-O, and other bonds, phosphates, poly(nucleic acids), sulfur containing polymers, sulfate and sulfonate groups, acidity, H_2SO_4.

15. Chemical Bonding, Other Atoms - Ionic bonds, ionic-covalent bonds; structures of SiO_2, polyphosphates, etc.; poly-electrolytes.

16. Near Equilibrium Kinetics Extended to Chemical Reactions - The concept of equilibrium in chemical reactions, the rate of approach to equilibrium, plots of extent of reaction versus time, rates of reactions, slopes of straight lines and curves, the differential, differentation, integration, differential equations, rate equations.

17. Rates of Chemical Reactions - Small molecule reactions; polymerization initiation, propagation, termination, side reactions.

18. Kinetics (cont'd) - "Chain reactions", thermal decompositions, combustion, branching free radical reactions, polymerization, molecular weight distribution.

19. Molecular Weights - MW of small molecule compounds, average MW, MW of air, average MW's of polymers.

20. Average Molecular Weights - Summations, weight and number average molecular weights ($\overline{M}_w$ & $\overline{M}_n$), etc.; summations and integration.

MW & MW Distribution of Real Polymers - How they affect properties; polyethylene - broad MW distributions; polystyrene; bi-nodal distributions; nylon 6 - effect of monomer and dimer; most probable distribution.

21. Polymers and States of Matter - Glassy, rubbery, crystalline - why and when?; specific volume, heat capacity, moduli of elasticity, viscosities, etc.; time scales - demonstration.

22. Glassy Polymers - Glass transitions, structures of glasses and crystals, SiO_2 glass, polystyrene, etc. - demonstrations.

23. Rubber Elasticity - Heating and cooling effects on stretching and release; force-elongation behavior; temperature dependence - contrasted with crystalline materials; similarity to p-V-T behavior of gases - demonstrations.

24. Crystallization of Polymers - Mixed crystalline and non-crystalline systems; crystallinity and strength and brittleness; rubberiness and toughness; chain folding; extended chain crystals "shish-ka-bobs".

25. Morphology of Polymers - Intercrystalline links, fibrils and ribbons, sheaves and spherulites, row and sheet crystallization demonstrations.

26. Flow Behavior of Polymers - Newtonian flow, pseudoplastic flow, elastic flow, extrusion, flow in dies.

27. Melt Spinning of Fibers - Demonstrations of melt spinning of nylon or PET, force analysis on extruded fiber, barus effect, etc.

28. Wet Spinning of Fibers - Demonstration of wet spinning of rayon fibers, chemistry and engineering of viscose and cuprammonium processes for making rayon, properties of rayon fibers.

29. Fiber Drawing - Demonstration of fiber drawing using nylon and polyester, structure changes on drawing, properties of drawn and undrawn fibers, mechanisms of drawing.

Fiber Texturing - Demonstration of texturing nylon by the hot knife and/ or false twist and knit-deknit techniques, structure and property changes in texturing, mechanisms of texturing, properties of fabrics from textured and untextured materials.

30. Fiber Properties - Demonstration and comparison of fiber properties for textile fibers showing the very high strength of fibers in tension.

31. New Fibers - High strength, high modulus fibers, BN, graphite, tungsten, organic fibers, Al_2O_3, etc.; making of fibers by crystal pulling, phase change, extrusion of metals, spinning of metals and glasses, etc.; uses of high strength fibers.

32. Dyes and Dyeing - Color in dyes, synthesis, substantivity.

33. Color - What is color? How do we perceive and measure color? Dyes-formation, matching, etc.

34. Classes of dyes - applying dyes, demonstration of screen printing.

35. Flammability - Combustion, ignition, propagation of flames and chars, demonstration of flame retardants on fabrics and carpets, flammability requirements and the future.

36. Finishing of Fabrics - Soil release, permanent press, flame retardance, etc., finishes; demonstration of soil release; some chemistry of modifying fibers and fabrics.

37. Yarn Formation - Cotton; converting cotton to yarn - opening, picking, carding, drawing, roving, and spinning demonstrated; blends.

Other Methods of Yarn Formation - Open end spinning, wet processes for yarn formation, yarns from continuous filaments.

38. Fabric Formation - Warping, slashing, drawing in, weaving demonstrated, dobby, Jacquard, air-jet, rapier, and hand looms; simple weaves; properties of woven fabrics.

39. Fabric Formation - Fancy weaves; Jacquard looms and automation.

40. Knitting - Weft and warp knitting demonstrated; basic stitches in knitting; yarns for knitting; properties of knitted fabrics.

Fancy Knitting - Raschel knits, automation in knitting, knitting machines of the future.

41. Carpets by Tufting, Needle Punching and Weaving - Development of carpets; demonstration of weaving, needle punching, and tufting; automation and design; chemistry of modern carpet making.

42. Design of Fabric Structures - Design of fabrics - woven and knitted; triaxial fabrics; three dimensional fabrics; fabrics as parts of composite structures - demonstration.

43. Composite structures - Survey of fiber reinforced composite structures and laminates; demonstration of structures and properties (tensile strength, impact strength, flexure, etc.) of composite structures, making of composite structures.

44. Mechanics of Composite Structures - How composite structures function, stress-strain behavior in typical composite structures, composite structures in the near future.

45. Nonwoven Structures - Fabric-like materials made by processes other than weaving or knitting; papers, films, spun-bonded materials, flocking, etc. - demonstrations.

46. Nonwoven Structures - Nonwoven materials formed to shape for garments and other uses, materials of the future, properties of nonwoven fabrics.

47. Research Reports by Student Participants.

48. Research Reports by Student Participants.

49. Research Reports by Student Participants.

APPENDIX IV

SCHEDULE - 1973 SUMMER PROGRAM IN
POLYMER, FIBER, AND TEXTILE SCIENCE AND ENGINEERING

Monday, June 25

8:00- 8:30	Registration
8:30-10:00	Seminar No. 1 - Introduction to polymers
10:00-12:00	Meet faculty, pay fees, tour campus
12:00- 1:00	Lunch
1:30- 3:00	Introduction to the library
3:00- 5:00	Seminar No. 2 - Force, stress and strain
5:00- 6:30	Free time
6:30- 7:30	Supper
8:00- 9:30	Rap session
9:30-10:30	Free time
11:00	Lights out

Tuesday, June 26

8:00-10:00	Seminar No. 3 - Equilibrium, static and dynamic
10:00-12:00	Meet faculty, pay fees, tour campus
12:00- 1:00	Lunch
1:00- 2:30	Tour Textile Engineering Building
3:00- 5:00	Seminar No. 4 - Near equilibrium kinetics
5:00- 6:30	Free time
6:30- 7:30	Supper
7:30-10:30	Free time
11:00	Lights out

Wednesday, June 27

8:00-10:00	Seminar No. 5 - Viscoelastic behavior
10:00-12:00	Meet faculty, discuss research
12:00- 1:00	Lunch
1:00- 3:00	Visit Engineering Experiment Station
3:00- 5:00	Seminar No. 6 - Molecular size
5:00- 6:30	Free time
6:30- 7:30	Supper
8:00- 9:30	Discussion period: science, engineering, etc.
9:30-10:30	Free time
11:00	Lights out

Thursday, June 28

8:00-10:00	Seminar No. 7 - Periodicity, chemical bonding, etc.
10:00-12:00	Conferences on research problems
12:00- 1:00	Lunch
1:00- 3:00	The laboratory and safety - discussion

Thursday, June 28 (continued)

3:00- 5:00	Seminar No. 8 - Vinyl polymerization
5:00- 6:30	Free time
6:30- 7:30	Supper
8:00- 9:30	Discussion period: mechanics, classical & quantum
9:30-10:30	Free time
11:00	Lights out

Friday, June 29

8:00-10:00	Seminar No. 9 - Vinyl polymerization (con't)
10:00-12:00	Conferences on research problems
12:00- 1:00	Lunch
1:00- 3:00	Visit Rich Computer Center
3:00- 5:00	Seminar No. 10 - C-O bonding
5:00- 6:30	Free time
6:30- 7:30	Supper
7:30-10:30	Free time
8:30-10:00	Concert - Chastain Park; Soccer Game - Grant Field
11:00	Lights out

Saturday, June 30

11:00	Visit High Museum of Art
1:00	Lunch
2:00	Visit State Capitol
3:00	Visit Underground Atlanta
5:00	Lunch
6:00	Baseball: Braves vs. Giants
10:00-11:00	Free time
12:00	Lights out

Sunday, July 1

Morning	Church
Afternoon	Free time

Monday, July 2

8:00-10:00	Seminar No. 11 - Oxygen Bonded Polymers - W. C. Tincher
10:00-12:00	Research
12:00- 1:00	Lunch
1:00- 3:30	Research
3:30- 5:00	Seminar No. 12 - C-N Bonding - W. C. Carter
5:00- 6:30	Free time
6:30	Supper
8:00- 9:30	Seminar No. 13 - Nylons, Proteins, etc. - W. C. Carter
9:30-11:00	Free time
11:00	Lights out

Tuesday, July 3

8:00-10:00	Seminar No. 14 - Bonding: Other Atoms - W. C. Carter
10:00-12:00	Research
12:00- 1:00	Lunch
1:00- 3:30	Research
3:30- 5:00	Seminar No. 15 - Ionic Bonds, Polyelectrolytes, Natural Polymers, etc. - W. C. Carter
5:00- 6:30	Free time
6:30	Supper
7:30-11:00	Free time
11:00	Lights out

Wednesday, July 4

10:00-12:00	Tennis and basketball
12:00- 1:00	Lunch
1:00- 5:00	Volleyball, softball, swimming
5:30	Supper
6:00	Leave for Lenox Square
9:30	Fireworks at Lenox Square
10:00	Return to Tech
11:00	Lights out

Thursday, July 5

8:00-10:00	Seminar No. 16 - Chemical Kinetics - W. C. Carter
10:00-11:30	Seminar No. 17 - Kinetics (con'd) - W. C. Tincher
11:30-12:00	Lunch
12:00- 5:30	Visit Fernbank Science Center
5:30- 6:30	Free time
6:30	Supper
8:00- 9:30	Seminar No. 18 - Chain Reactions - W. C. Carter
9:30-11:00	Free time
11:00	Lights out

Friday, July 6

8:00-10:00	Seminar No. 19 - Molecular Weights - J. L. Lundberg
10:00-12:00	Research
12:00- 1:00	Lunch
1:00- 3:30	Research
3:30- 5:00	Seminar No. 20 - Molecular Weight Averages - J. L. Lundberg
5:00- 6:30	Free time
6:30	Supper
7:00-11:00	Free time
11:00	Lights out

Saturday, July 7

8:00- 5:00	Research or free time
7:00 p.m.	Leave for Jazz Festival
10:30 p.m.	Return to campus
11:30 p.m.	Lights out

Sunday, July 8

9:00-11:00	Free time, library work, computing, experimental research by arrangement
11:00	Lights out

Monday, July 9

8:00- 9:00	Seminar No. 21 - Molecular weights, averages, statistics, summations, integrations, etc. - J. L. Lundberg
9:00-10:30	Seminar No. 22 - Polymers and states of matter, glassy polymers - J. L. Lundberg
10:30-12:00	Research
12:00- 1:00	Lunch
1:00- 3:00	Computer seminar - Group I
1:00- 5:00	Research
3:00- 5:00	Science movies (optional) - Textile Auditorium
5:00-10:30	Free time and research
8:00- 9:30	Science movies (optional)
11:00	Lights out

Tuesday, July 10

8:00- 9:00	Seminar No. 23 - Rubber elasticity - J. L. Lundberg
9:00-10:30	Seminar No. 24 - Crystallization of polymers - J. L. Lundberg
10:30-12:00	Research
12:00- 1:00	Lunch
1:00- 4:00	Computer seminar - Group II
1:00- 5:00	Research
4:00- 5:30	Science movies (optional)
5:00- 8:00	Free time and research
8:00- 9:30	Special seminar - Nuclear science and engineering - G. Eichholz
9:30-10:30	Free time and research
11:00	Lights out

Wednesday, July 11

8:00-10:00	Seminar No. 25 - Morphology of polymers - J. L. Lundberg
10:00-12:00	Research
12:00- 1:00	Lunch

Wednesday, July 11 (continued)

1:00- 5:00	Computer seminar - Group III
1:00- 5:00	Research
5:00-10:30	Free time and research
11:00	Lights out

Thursday, July 12

8:00-10:00	Seminar No. 26 - Flow behavior of polymers - J. L. Lundberg
10:00-12:00	Research
12:00- 1:00	Lunch
1:00- 5:00	Research
1:00- 3:00	Science movies (optional)
5:00-10:30	Free time and research
8:00- 9:30	Science movies (optional)
11:00	Lights out

Friday, July 13

8:00-10:00	Seminar No. 27 - Melt spinning of fibers - J. L. Lundberg
10:00-12:00	Research
12:00- 1:00	Lunch
1:00- 3:30	Research
3:30	Special seminar - Observations on the White House Fellowship Program - J. Bostic, White House Fellow
5:00-10:30	Free time and research
12:00	Lights out

Saturday, July 14

9:00- 3:00	Free time and research
3:00-10:00	Trip to Stone Mountain (tentative)

Sunday, July 15

8:00-11:00	Free time

Monday, July 16

8:00- 9:00	Seminar No. 28 - Wet and Dry Spinning of Fibers - W. C. Tincher
9:00-10:30	Research
10:30	Special Seminar - Stability of Polymers - W. L. Hawkins
12:00- 1:00	Lunch
1:00- 5:00	Research
5:00-11:00	Free time and research
8:00- 9:30	Science movies (optional)
11:00	Lights out

Tuesday, July 17

8:00- 9:30	Seminar No. 29 - Drawing and Texturing of Fibers - W. C. Carter
9:30-12:00	Research
12:00- 1:00	Lunch
1:00- 5:00	Research
5:00-11:00	Free time and research
8:00- 9:30	Science movies (optional)
11:00	Lights out

Wednesday, July 18

8:00- 9:30	Seminar No. 30 - Yarn Formation - D. R. Gentry
9:30- 2:00	Research
12:00- 1:00	Lunch
2:00-11:00	Trip to "Six Flags Over Georgia"

Thursday, July 19

8:00- 9:30	Seminar No. 31 - Fabric Formation - D. R. Gentry
9:30-12:00	Research
12:00- 1:00	Lunch
1:00- 1:30	Student Meeting
1:30- 5:00	Research
1:30- 5:00	Group meetings with Dr. Leo Sciuchetti, NSF
5:30- 7:00	Buffet dinner with incoming freshmen
7:00- 8:30	Assembly - "Student Life" - EE Auditorium
8:30-10:00	Discussion session - TE Lobby
8:30-11:00	Research
11:00	Lights out

Friday, July 20

8:00- 9:30	Seminar No. 32 - Fancy Weaves - D. R. Gentry
9:30-12:00	Research, visits with Dr. Leo Sciuchetti, NSF
12:00- 1:00	Picnic - Peter's Park - with incoming freshmen
1:00- 5:00	Research, visits with Dr. Leo Sciuchetti, NSF
5:00- 7:30	Free time, research
7:30- 9:30	Movie - EE Auditorium - with incoming freshmen
9:30-11:00	Free time
11:00	Lights out

Saturday, July 21

8:00- 9:30	Seminar No. 33 - Chemistry of Dyes - J. L. Lundberg
9:30-11:00	Assembly: "Student Life" (optional) - EE Auditorium
9:30- 5:00	Research
5:00- 8:00	Free time, research
8:00-12:00	Saturday night at the movies
12:00	Lights out

Saturday, July 28

8:30-10:00	Seminar No. 38 - Dyeing - W. C. Carter
10:00- 5:00	Research
5:00- 7:30	Free time, research
7:30	Saturday night out - movies, etc.
12:00	Lights out

Sunday, July 29

10:00 a.m.	Leave for picnic - Lake Allatoona
11:00 p.m.	Lights out

Monday, July 30

8:00- 9:30	Seminar No. 38 - Knitting - J. L. Lundberg
9:30-12:00	Research
12:00- 1:00	Lunch
1:00- 5:00	Research
5:00-11:00	Free time, research
8:00- 9:30	Movies on science (optional)
11:00	Lights out

Tuesday, July 31

8:00-10:00	Seminar No. 39 - Carpets - W. C. Boteler
10:00-12:00	Research
12:00- 1:00	Lunch
1:00	Special Seminar - Physics, glasses, polymers, etc. - G. W. Grim
2:00- 5:00	Research
5:00-11:00	Free time, research
11:00	Lights out
8:00- 9:30	Science movies (optional)

Wednesday, August 1

8:30	Leave for Jefferson Mills
9:30-11:30	Visit Jefferson Mills
11:30- 1:00	Return to campus
1:00- 2:00	Lunch
2:00- 5:00	Research
5:00- 8:00	Free time, research
8:00- 9:30	Seminar No. 40 - Dyeing - W. C. Carter
9:30-11:00	Free time, research
11:00	Lights out

Thursday, August 2

8:00-10:00	Seminar No. 41 - Design of fabric structures - W. D. Freeston
10:00-12:00	Research
12:00- 1:00	Lunch
1:00- 5:00	Research
5:00-11:00	Free time, research
11:00	Lights out

Friday, August 3

8:00- 9:00	Research
9:00-10:30	Seminar No. 42 - Composite structures - W. D. Freeston
10:30-12:00	Research
12:00- 1:00	Lunch
1:00- 5:00	Research
5:00-11:00	Free time, research
11:00	Lights out

Saturday, August 4

9:00- 5:00	Research
5:00-12:00	Free time
8:00-12:00	Saturday night at the movies, etc.
12:00	Lights out

Sunday, August 5

9:00-12:00	Free time
12:00	Leave for Lundberg's house
12:30- 5:30	Tennis, swimming, ball, pool, piano, etc.
5:30- 7:00	Supper (not hamburgers!)
7:00-	Relaxing
11:00	Lights out

Monday, August 6

8:30-10:00	Seminar No. 45 - Textiles, U.S.A.-1980's - J. L. Lundberg
10:00-12:00	Research
12:00- 1:00	Lunch
1:00- 5:00	Research
5:00-11:00	Free time, research
8:00- 9:30	Science movies (optional)
11:00	Lights out

Tuesday, August 7

8:30- 9:00	Seminar No. 46 - Polymers, college curricula, etc. - J. L. Lundberg
9:00-12:00	Research
12:00- 1:00	Lunch
1:00- 5:00	Research
5:00-11:00	Free time, research
11:00	Lights out

Wednesday, August 8

8:30-10:00	Seminar No. 47 - Presentations by students
10:00-12:00	Research
12:00- 1:00	Lunch
1:00- 5:00	Research
5:00-11:00	Free time, research
7:00-10:00	Special seminar (optional) - Thermodynamics, quantum mechanics and statistical thermodynamics - J. L. Lundberg
11:00	Lights out

Thursday, August 9

8:30-10:00	Seminar No. 48 - Presentations by students
10:00-12:00	Research
12:00- 1:00	Lunch
1:00- 5:00	Research
5:00-11:00	Free time, research
11:00	Lights out

Friday, August 10

8:30-10:00	Seminar No. 49 - Presentations by students
10:00-12:00	Research
12:00- 1:00	Lunch
1:00- 6:00	Open house, tours, demonstrations of research, etc.
2:00- 3:00	Recognition of students, Room 208
3:00- 4:00	Refreshments
4:00- 6:00	Open house, depart from campus, etc.

Saturday, August 11

8:00- 6:00	Depart from campus

APPENDIX V

A partial list of films shown during the 1973 student science training program at Georgia Tech is as follows:

Encyclopedia Brittannica Films -

- Patterns of Scientific Investigation
- Molecular Theory of Matter
- Laws of Motion
- Sound Waves and Their Sources
- Light Waves and Their Uses
- Polarization of Light
- Heat - Its Nature and Transfer
- Dr. Black's Observations on Heat
- Rheological Behavior of Fluids
- Determination of the Triple Point of Water
- Synthetic Fibers - Nylon and Rayon
- Sulfur - Its Physical States and Properties
- Proton Motions in Ice
- The Silkworm
- Spiders
- Plant Motions
- Osmosis
- Photosynthesis
- DNA: Molecule of Heredity
- Muscle: Chemistry of Contraction
- Muscle: Dynamics of Contraction
- Muscle: Electrical Activity of Contraction

Other -

- Physical Chemistry of Polymers (Bell Labs)
- Textile Processing (S.C.Ed.TV)

NSF-SSTP QUESTIONAIRE

1. There were (too 2 many, too 3 few) lectures during the program. (right number: 21)

2. Each lecture on the average was (too 0 short, too 15 long). (right length: 11)

3. The ideal length for a lecture in this program would be (1 hr., 1 1/2 hrs., 2 hrs., 2 1/2 hrs., 3 hrs.).
   10 11 3 1 2 11 11 0 0 (no comment: 3)

4. Lecture material was (always, often, seldom, never) at a level difficult for me to understand.

5. The lectures which interested me the most had as their subject:

   a) Color (W. C. Tincher) - 9

   b) Fibrous tissues in medicine (R. A. Liebelt) - 4

   c) Fabric formation (D. R. Gentry) - 4

   d) Flammability (W. C. Tincher) - 4

6. The lectures which were least interesting had as their subject:

   a) Calculus (J. L. Lundberg) - 5

   b) Fabric formation (D. R. Gentry) - 4

   c) Organic chemistry (W. C. Tincher) - 4

7. There were (too 0 many, too 17 few) lectures given by people outside the textile department's faculty. (right number: 9)

8. There was (too 4 little, too 1 much) material covered during the 7 week period. (right number: 21)

9. There were (too 0 many, too 7 few) research topics from which to choose. (right number: 19)

10. Faculty assistance on my research topic was (18 excellent, good, fair, poor).
    5 3 0

11. Materials and instruments needed to carry out my research were (easy, difficult) to obtain.
    15 10 (no comment: 1)

12. (More, Less) time should have been allotted for research.
    8 1 (right amount: 17)

13. (More, Less) time should have been devoted to familiarizing me with Tech's research facilities. (right amount: 13)
    13 0

Specifically: Other schools at Georgia Tech - 5

14. (More, Less) time should have been devoted to familiarizing me with Tech's recreational facilities. 6 1 (right amount: 19)

Specifically: Swimming pool & instruction - 2; football - 1; classes at Student Center - 1; rifle range - 1

15. There were (too many, too few) organized outings. 1 5 (right number: 20)

16. The outing I most enjoyed was: Six Flags Over Georgia - 13; Callaway Gardens & Warm Springs - 6; Lundberg's House - 6; Lake Alatoona - 5; Braves - Giants Baseball Game - 2

17. The outing I least enjoyed was: Jefferson Mills - 7; Callaway Gardens & Warm Springs - 3; Lake Alatoona - 2; Braves - Giants Baseball Game - 2; Stone Mountain (rain) - 2

18. I would like to have had (more, less) free time on weeknights and weekends. 8 0 (right amount: 18)

19. Had I had more free time I would have used it to Read - 4; study for research - 3; work in gym - 2; sleep - 2; learn more about Georgia Tech - 2; swim - 2; visit Atlanta - 2; sight-see - 1; party - 1

20. I would recommend this program to my fellow students if:

a) it were run much the same way 12
b) a few changes were made 11
c) the following major changes were made 1 (no comment: 2)

Research advisor had little free time; graduate student wasn't as well prepared as he could have been. (In this case we found a research problem and advisors for participant to satisfy his desire to work in a specific area.)

Additional Comments:

Program was excellent: 11

Pleased with program: 8

No comment: 4

Need better access to equipment: 1

Food needs improvement: 1

Need more familiarization with research before selecting problem: 1

We should get to work on problems at beginning of first week: 1

Students with limited background should not be placed in same group as those with advanced backgrounds: 1